

Exhibit A

USPTO PATENT FULL-TEXT AND IMAGE DATABASE[Home](#)[Quick](#)[Advanced](#)[Pat Num](#)[Help](#)[Next List](#)[Bottom](#)[View Cart](#)*Searching US Patent Collection...***Results of Search in US Patent Collection db for:****TTL/"golf ball": 2718 patents.***Hits 1 through 50 out of 2718*[Next 50 Hits](#)[Jump To](#)[Refine Search](#)

TTL/"golf ball"

PAT. NO. Title

- 1 [7,131,915](#) T [Three-layer-cover golf ball](#)
- 2 [7,131,914](#) T [Method of making a golf ball with a multi-layer core](#)
- 3 [7,129,295](#) T [Golf ball](#)
- 4 [7,128,864](#) T [Process forming a cover layer for a golf ball](#)
- 5 [7,128,665](#) T [Golf ball](#)
- 6 [D531,248](#) T [Golf ball indicator device](#)
- 7 [D530,769](#) T [Golf ball and golf tee holder](#)
- 8 [D530,767](#) T [Golf ball marker device](#)
- 9 [D530,766](#) T [Golf ball locator](#)
- 10 [7,125,915](#) T [Lipid-based nanotubules for controlled release of healing agents in golf ball layers](#)
- 11 [7,125,348](#) T [Thick-covered, soft core golf ball](#)
- 12 [7,125,347](#) T [Golf ball and golf ball manufacturing method](#)
- 13 [7,125,346](#) T [Solid golf ball](#)
- 14 [7,125,345](#) T [Low deformation golf ball](#)
- 15 [D530,376](#) T [Golf ball dispensing machine](#)
- 16 [7,122,588](#) T [Golf ball](#)
- 17 [7,121,961](#) T [Low volume cover for a golf ball](#)
- 18 [7,121,960](#) T [Golf ball dimple arrangement method](#)
- 19 [7,121,959](#) T [Multi-piece solid golf ball](#)
- 20 [D530,047](#) T [Golf ball shaped leash holder](#)
- 21 [7,118,497](#) T [Golf ball with soft core](#)

22 7,118,496 T Golf ball
23 7,118,495 T Low deformation golf ball
24 7,118,494 T Multi-piece solid golf ball
25 7,115,698 T Golf ball
26 7,115,049 T Golf ball with large center core
27 D529,239 T Golf ball fetch toy
28 7,112,149 T Golf ball
29 7,108,615 T Golf ball
30 D528,165 T Golf ball dispensing machine
31 7,105,610 T Thin-layer-covered golf ball with improved velocity
32 7,104,421 T Golf ball teeing device
33 7,101,952 T Polyurethane material for a golf ball cover
34 7,101,934 T Coating composition used for golf ball and golf ball using the same
35 7,101,292 T Multi-piece solid golf ball
36 D527,061 T Golf ball with dimple pattern
37 7,094,162 T Golf ball
38 7,094,161 T Golf ball
39 7,094,160 T Golf ball with small inner core
40 7,091,269 T Golf ball
41 7,091,264 T Rubber composition for preparing golf ball components
42 7,090,799 T Golf ball and method for preparing golf ball
43 7,090,798 T Multilayer golf ball with a thin thermoset outer layer
44 7,090,593 T Golf ball with non-circular dimples
45 7,090,592 T Multi-piece solid golf ball
46 7,089,817 T Method of analyzing physical property of golf ball
47 D526,239 T Golf ball autograph display
48 7,087,201 T Process for producing golf ball
49 7,086,970 T Multi-piece golf ball
50 7,086,969 T Multi-piece solid golf ball

Home	Quick	Advanced	Pat Num	Help
Next List	Top	View Cart		

Exhibit B1

USPTO PATENT FULL-TEXT AND IMAGE DATABASE[Home](#)[Quick](#)[Advanced](#)[Pat Num](#)[Help](#)[Next List](#)[Bottom](#)[View Cart](#)*Searching US Patent Collection...***Results of Search in US Patent Collection db for:****TTL/semiconductor:** 64574 patents.*Hits 1 through 50 out of 64574*[Next 50 Hits](#)[Jump To](#)[Refine Search](#) | TTL/semiconductor

PAT. NO. Title

- 1 [7,134,111](#) T Layout method and apparatus for arrangement of a via offset from a center axis of a conductor and semiconductor device thereof
- 2 [7,134,060](#) T Semiconductor integrated circuit including operation test circuit and operation test method thereof
- 3 [7,133,788](#) T Process controller for semiconductor manufacturing
- 4 [7,133,735](#) T Experiment management system and method thereof in semiconductor manufacturing environment
- 5 [7,133,653](#) T Receiver and composite component having local oscillator components and mixing circuit integrally formed on semiconductor substrate
- 6 [7,133,431](#) T Semiconductor laser device and method for fabricating the same
- 7 [7,133,430](#) T Semiconductor laser element and method of fabrication thereof
- 8 [7,133,314](#) T Non-volatile semiconductor memory device with reduced chip real estate area for transfer transistors
- 9 [7,133,312](#) T Readout circuit for semiconductor memory device based on a number of pulses generated by a voltage-controlled oscillator
- 10 [7,133,306](#) T Semiconductor memory device for securely retaining data
- 11 [7,133,305](#) T Semiconductor memory device
- 12 [7,133,303](#) T Dynamic type semiconductor memory apparatus
- 13 [7,133,140](#) T Apparatus and measurement procedure for the fast, quantitative, non-contact topographic investigation of semiconductor wafers and other mirror like surfaces
- 14 [7,133,128](#) T System and method for measuring properties of a semiconductor substrate in a non-destructive way
- 15 [7,133,055](#) T Digital semiconductor based smart surface

16 7,133,012 T Semiconductor device provided with matrix type current load driving circuits, and driving method thereof

17 7,132,900 T High frequency semiconductor integrated circuit device, wireless electric unit and wireless communication system

18 7,132,887 T Low voltage semi-folded metal oxide semiconductor field effect transistor (MOSFET) amplifier circuit

19 7,132,868 T Semiconductor device

20 7,132,855 T Level shift circuit for use in semiconductor device

21 7,132,850 T Semiconductor integrated circuit and circuit design apparatus

22 7,132,842 T Semiconductor device, driving method and inspection method thereof

23 7,132,756 T Semiconductor device and method for manufacturing the same

24 7,132,755 T Adhesive film for manufacturing semiconductor device

25 7,132,753 T Stacked die assembly having semiconductor die overhanging support

26 7,132,752 T Semiconductor chip and semiconductor device including lamination of semiconductor chips

27 7,132,750 T Semiconductor component having conductors with wire bondable metalization layers

28 7,132,749 T Semiconductor device, method for manufacturing the same, circuit substrate, electro-optical apparatus, and electronic equipment

29 7,132,748 T Semiconductor apparatus

30 7,132,742 T Semiconductor device, method of manufacturing the same, circuit board, and electronic instrument

31 7,132,741 T Semiconductor chip assembly with carved bumped terminal

32 7,132,740 T Semiconductor package with conductor impedance selected during assembly

33 7,132,738 T Semiconductor device having multiple semiconductor chips stacked in layers and method for manufacturing the same, circuit substrate and electronic apparatus

34 7,132,733 T Semiconductor device

35 7,132,732 T Semiconductor device having two distinct sioch layers

36 7,132,731 T Semiconductor component and assembly having female conductive members

37 7,132,729 T Semiconductor device and method of manufacturing same

38 7,132,726 T Integrated semiconductor circuit having a logic and power metallization without intermetal dielectric

39 7,132,725 T Semiconductor device

40 7,132,720 T Semiconductor device having guard ring and manufacturing method thereof

41 7,132,719 T Semiconductor devices and methods of fabricating the same

42 7,132,718 T Fabrication method and structure of semiconductor non-volatile memory device

43 7,132,717 T Power metal oxide semiconductor transistor layout with lower output resistance and high current limit

44 7,132,715 T Semiconductor device having a spacer layer doped with slower diffusing atoms than substrate

45 7,132,710 T Capacitor, semiconductor device having the same, and method of manufacturing the semiconductor device

46 7,132,709 T Semiconductor device including a capacitor having a capacitive insulating film of an insulating metal oxide

47 7,132,708 T [Semiconductor memory device having self-aligned contacts and method of fabricating the same](#)

48 7,132,701 T [Contact method for thin silicon carbide epitaxial layer and semiconductor devices formed by those methods](#)

49 7,132,699 T [Compound semiconductor device and its manufacture](#)

50 7,132,691 T [Semiconductor light-emitting device and method for manufacturing the same](#)



Exhibit B2

USPTO PATENT FULL-TEXT AND IMAGE DATABASE

Home	Quick	Advanced	Pat Num	Help
Next List	Bottom	View Cart		

*Searching US Patent Collection...***Results of Search in US Patent Collection db for:****TTL/telephone:** 13224 patents.*Hits 1 through 50 out of 13224*[Next 50 Hits](#)[Jump To](#)[Refine Search](#) | TTL/telephone**PAT. NO. Title**

- 1 7,133,850 T Postage system having telephone answering and message retrieval capability
- 2 7,133,680 T Method for assigning frequencies to base stations of a mobile telephone network
- 3 7,133,665 T Telephone with dynamically programmable push buttons for access to advanced applications
- 4 7,133,662 T Methods and apparatus for restricting access of a user using a cellular telephone
- 5 7,133,509 T Method and system for charging a set activation fee for pay telephone usage
- 6 7,133,499 T Systems and methods for processing emergency calls through a public switched telephone network
- 7 7,133,364 T Apparatus and method for internet telephone communication
- 8 RE39,376 T System for accessing amenities through a public telephone network
- 9 D531,613 T Telephone
- 10 7,130,647 T Cordless telephone system
- 11 7,130,617 T Telephone which enables timely input and presentation of information
- 12 7,130,609 T Wireless backup telephone device and associated support system
- 13 7,130,594 T Power amplification device, especially with reduced input dynamic swing, in particular for a cellular mobile telephone
- 14 7,130,417 T Telephone-coupled device for internet access
- 15 7,130,399 T Methods and systems for assembling telephone line records
- 16 7,130,392 T System for providing commercial advertising to a telephone user
- 17 7,130,391 T Automated method and system for interacting with telephone call trees
- 18 7,130,386 T System for providing commercial advertising to a telephone user on hold

19 7,129,969 T Telephone unit having telephone directory with picture data and method for generating telephone directory with picture data

20 7,129,928 T Joystick controller for cellular telephone

21 7,129,588 T Portable telephone

22 D530,701 T Telephone

23 D530,697 T Radio telephone

24 7,127,663 T Bad frame indicator for radio-telephone receivers in GSM mobile systems

25 7,127,053 T Call scheduling on a telephone network using a telephony interface

26 7,127,051 T System and method for providing advanced telephony services using a virtual telephone number

27 7,127,045 T Automatic answering telephone set with individual answering and method thereof

28 7,126,942 T Apparatus and method for integrated computer controlled call processing in packet switched telephone networks

29 7,126,940 T Positioning a subscriber terminal in a packet-switched mobile telephone network

30 7,126,932 T User equipment device for a UMTS mobile telephone communications system

31 D530,303 T Telephone

32 D530,302 T Base for cordless telephone with answering device

33 7,123,946 T Portable information terminal device and telephone directory display method used by the device

34 7,123,913 T Cellular telephone

35 7,123,903 T Wireless telephone and wireless telephone system

36 7,123,715 T Telephone apparatus

37 7,123,701 T Telephone outlet for implementing a local area network over telephone lines and a local area network using such outlets

38 7,123,699 T Voice mail in a voice over IP telephone system

39 7,123,697 T Method and system for providing a call answering service between a source telephone and a target telephone

40 7,123,606 T Voice over IP device capable of auto-selectively dialing up public switch telephone or internet phone and the method thereof

41 7,121,962 T Golf round data system with cellular telephone and player help features

42 D529,894 T Telephone set

43 D529,888 T Portable telephone

44 7,120,454 T Auto sensing home base station for mobile telephone with remote answering capabilities

45 7,120,426 T Automatic telephone service forwarding device

46 7,120,260 T Jack circuit and portable type electronic apparatus and telephone set using the same

47 7,120,239 T System and method for providing no answer detail service for telephone calls that are not completed

48 7,120,238 T Sensor-controlled telephone system

49 7,120,234 T Integrated tone-based and voice-based telephone user interface

50 D529,477 T Telephone



Exhibit B3

USPTO PATENT FULL-TEXT AND IMAGE DATABASE[Home](#)[Quick](#)[Advanced](#)[Pat Num](#)[Help](#)[Next List](#)[Bottom](#)[View Cart](#)*Searching US Patent Collection...***Results of Search in US Patent Collection db for:****TTL/tire: 11342 patents.****Hits 1 through 50 out of 11342**[Next 50 Hits](#)[Jump To](#)[Refine Search](#) | **PAT. NO. Title**

- 1 7,133,736 **T** Method for designing a tire and method for producing at least one tire
- 2 7,132,939 **T** Integrated self-powered tire revolution counter
- 3 7,132,938 **T** Tire pressure warning system
- 4 7,132,930 **T** Monitoring device and tire combination
- 5 7,131,476 **T** Pneumatic tire and method of manufacturing the tire
- 6 7,131,475 **T** High and medium performance tire for vehicles
- 7 7,131,474 **T** Tire with rubber tread of load bearing central and lateral zones
- 8 7,131,323 **T** Tire inflation pressure sensing apparatus with function of spare wheel identification
- 9 7,131,257 **T** Metal cord and pneumatic tire including the same
- 10 H2,175 **T** Aircraft wheel and tire compressor
- 11 D531,573 **T** Tire tread
- 12 D531,572 **T** Tire tread
- 13 D531,571 **T** Automobile tire
- 14 D531,570 **T** Tread portion of an automobile tire
- 15 D531,569 **T** Motorcycle tire
- 16 7,129,279 **T** Lightweight tire support and composition and method for making a tire support
- 17 7,128,942 **T** Vehicle tire
- 18 7,128,794 **T** Method for retreading a tire
- 19 7,128,545 **T** Tire curing bladder
- 20 7,128,117 **T** Expandable tire building drum with alternating fixed and expandable segments, and contours for sidewall inserts

21 7,128,116 T Device for the fabrication of a tire reinforcement, suitable for tires of large width

22 7,128,115 T Method and an apparatus for manufacturing components of a tire for vehicle wheels

23 7,128,114 T Pneumatic tire and method of manufacturing the tire

24 7,128,113 T ATV radial tire

25 7,128,112 T Tire for two-wheeled vehicles comprising circumferential crown reinforcement elements

26 7,128,111 T Pneumatic tire having shoulder blocks with V-shaped axially inner edge and convexly curved axially outer surface

27 7,128,110 T Agricultural wheel tire

28 D531,116 T Tire tread

29 D531,115 T Tread portion of an automobile tire

30 D531,114 T Tire tread

31 D531,113 T Tire tread

32 D531,112 T Tire tread

33 D531,111 T Tread portion of an automobile tire

34 D531,110 T Automobile tire

35 D531,109 T Tire tread

36 D531,108 T Tire tread

37 D530,726 T Lawn mower tire

38 D530,661 T Automobile tire

39 7,125,511 T Venting device which stops the spews on the tire

40 7,124,800 T Tire removal tool

41 7,124,789 T Automatic air feeding mechanism for pneumatic tires, and pneumatic tire connecting device

42 D530,268 T Tire tread

43 D530,267 T Tire tread

44 D530,266 T Tire tread

45 D530,265 T Tire tread

46 D530,264 T Tire tread

47 D530,263 T Tire tread

48 D530,262 T Tire tread

49 7,124,002 T Tire air pressure abnormality warning device and method

50 7,122,220 T Method and apparatus for protecting innerliner of a green tire

[Next List](#) [Top](#) [View Cart](#)

[Home](#)

[Quick](#)

[Advanced](#)

[Pat Num](#)

[Help](#)

Exhibit B4

USPTO PATENT FULL-TEXT AND IMAGE DATABASE

Home	Quick	Advanced	Pat Num	Help
Next List	Bottom	View Cart		

*Searching US Patent Collection...***Results of Search in US Patent Collection db for:****TTL/shoe:** 8608 patents.*Hits 1 through 50 out of 8608*[Next 50 Hits](#)[Jump To](#)[Refine Search](#)

TTL/shoe

PAT. NO. Title

- 1 [7,131,519](#) T Drum brake device with an automatic shoe clearance adjustment apparatus
- 2 [7,131,219](#) T Shoe with leg support
- 3 [D531,398](#) T Portion of a shoe upper
- 4 [D531,397](#) T Portion of a shoe upper
- 5 [D531,396](#) T Portion of a shoe upper
- 6 [D531,395](#) T Outsole for a shoe
- 7 [D531,393](#) T Outsole for a shoe
- 8 [7,127,837](#) T Shoe whose upper is horizontally openable/closable from the side by means of a slide fastener
- 9 [7,127,836](#) T Shoe and boot protecting assembly
- 10 [7,127,835](#) T Athletic shoe with improved heel structure
- 11 [7,127,834](#) T Shoe sole structures using a theoretically ideal stability plane
- 12 [7,127,833](#) T Shoe upper and footwear constructed therewith and process for its production
- 13 [D530,905](#) T Portion of a shoe midsole
- 14 [D530,904](#) T Portion of a shoe upper
- 15 [D530,903](#) T Portion of a shoe upper
- 16 [D530,902](#) T Shoe
- 17 [D530,901](#) T Shoe
- 18 [D530,900](#) T Shoe
- 19 [D530,899](#) T Shoe
- 20 [D530,898](#) T Shoe

21 D530,897 T Shoe
22 D530,892 T Outsole for a shoe
23 D530,890 T Shoe
24 D530,889 T Shoe
25 D530,888 T Heelless ballet shoe
26 D530,540 T Stackable shoe rack
27 D530,504 T Portion of a shoe upper
28 D530,503 T Side element of a shoe upper
29 D530,502 T Side element of a shoe upper
30 D530,501 T Shoe
31 D530,500 T Shoe
32 D530,499 T Shoe
33 D530,498 T Shoe
34 D530,497 T Shoe
35 D530,496 T Shoe
36 D530,495 T Shoe
37 D530,494 T Outsole of a shoe
38 D530,493 T Outsole of a shoe
39 D530,492 T Outsole for a shoe
40 7,124,519 T Shoe sole having improved flexibility and method for making the same
41 D530,075 T Portion of a shoe upper
42 D530,074 T Portion of a shoe upper
43 D530,073 T Portion of a shoe upper
44 D530,072 T Shoe
45 D530,071 T Shoe
46 D530,070 T Shoe
47 D530,068 T Golf shoe upper
48 D530,065 T Portion of a shoe sole
49 D530,064 T Shoe
50 D530,063 T Shoe

Next List	Top	View Cart		
Home	Quick	Advanced	Pat Num	Help

Exhibit B5

USPTO PATENT FULL-TEXT AND IMAGE DATABASE

Home	Quick	Advanced	Pat Num	Help
Next List	Bottom	View Cart		

Searching US Patent Collection...

Results of Search in US Patent Collection db for:

TTL/screw: 4489 patents.

Hits 1 through 50 out of 4489

[Next 50 Hits](#)

[Jump To](#)

[Refine Search](#) | TTL/screw

PAT. NO. Title

- 1 [7,131,827](#) **T** Stator for an eccentric screw pump or an eccentric worm motor operating on the moineau principle
- 2 [7,131,358](#) **T** Quick release device for releasing screw bit from socket
- 3 [7,131,183](#) **T** Screw in high voltage housing terminal for ignition coil
- 4 [D531,491](#) **T** Screw
- 5 [7,128,513](#) **T** Screw and driver therefor
- 6 [7,128,464](#) **T** Method and device for regulating pressure in a single-screw degassing extruder or in a cascade extruder
- 7 [7,128,199](#) **T** Hooked dust scraper for ball screw unit
- 8 [7,127,970](#) **T** Tool for tightening and loosening a wing nut or wing screw that secures a motor vehicle wheel
- 9 [7,127,791](#) **T** Split nut for use with a rod having dual directional screw threads about a common diameter
- 10 [D530,581](#) **T** Electric screw driver body
- 11 [7,126,628](#) **T** Screw auto-detection and selection device
- 12 [7,125,250](#) **T** Screw device for orthodontic treatment
- 13 [7,125,209](#) **T** Quick-change mechanism for use with the stationary spindle of a Davenport.RTM. automatic screw machine
- 14 [7,125,207](#) **T** Tool holder with integral coolant channel and locking screw therefor
- 15 [7,124,665](#) **T** Screw positioning device for a screwdriver
- 16 [7,124,552](#) **T** Device for screwing screw-type closures onto containers
- 17 [7,124,421](#) **T** Lead screw adjustment structure of disc drive
- 18 [7,124,419](#) **T** Feed screw driver and information recorder/reproducer

19 7,122,741 **T** Contact screw

20 7,121,174 **T** Screw-feeding device for a screw-driving tool

21 7,120,504 **T** Epicardial screw-in lead

22 7,118,572 **T** Femoral neck compression screw system with ortho-biologic material delivery capability

23 7,111,531 **T** Screw and screwdriver

24 7,107,883 **T** Screw-driving tool for implant screws

25 7,107,664 **T** Screw thread cutting apparatus and method

26 7,105,742 **T** Electrical box with mounting screw guide

27 7,104,991 **T** Method and device for using extended interference fit screw shanks for spinal stabilization

28 7,104,772 **T** Screw compressor

29 7,104,770 **T** Eccentric screw-type pump with spare stator

30 7,104,167 **T** Screw guides and cartridges

31 7,102,296 **T** Screw-in transformer

32 7,101,640 **T** Screw-in vent plug for lead-acid batteries

33 7,101,177 **T** Screw device for orthodontic treatment

34 7,101,133 **T** Thread-forming screw fastener

35 7,100,482 **T** Electrically powered hand-held screw driver

36 7,097,345 **T** Screw with heat exchange function, mixer and extruder

37 7,097,079 **T** Automatic dosing device with a dosing screw and the use of such an automatic dosing device

38 7,096,681 **T** System and method for variable speed operation of a screw compressor

39 7,096,071 **T** Set for installing an intracardiac stimulation or defibrillation lead equipped with a screw

40 7,093,665 **T** Method of adapting a downhole multi-phase twin screw pump for use in wells having a high gas content and a downhole multi-phase twin screw pump

41 7,091,683 **T** Method of monitoring and controlling the seating of screws to the optimum point of grip independent of screw size and material density

42 7,090,514 **T** Screw radial connector for electric wires

43 7,090,495 **T** Dental implant screw and post system

44 7,090,453 **T** Screw

45 7,090,452 **T** Tapping screw

46 7,090,347 **T** Screw-less hinge structure for spectacles

47 7,089,654 **T** Ball given quantity supply apparatus and method and apparatus for assembling ball screw apparatus

48 7,087,059 **T** Powered bone screw device

49 7,087,057 **T** Polyaxial bone screw

50 7,086,303 **T** Lead screw for linear actuator, and method of manufacturing the same

[Next List](#)[Top](#)[View Cart](#)[Home](#)[Quick](#)[Advanced](#)[Pat Num](#)[Help](#)

EXHIBIT C

CONFIDENTIAL EXHIBIT

Exhibit D



US005609532A

United States Patent

[19]

Chikaraishi**Patent Number:** 5,609,532**Date of Patent:** Mar. 11, 1997**[54] THREAD-WOUND GOLF BALL**[75] Inventor: **Toshio Chikaraishi**, Akishima, Japan[73] Assignee: **Bridgestone Sports Co., Ltd.**, Tokyo, Japan[21] Appl. No.: **541,262**[22] Filed: **Oct. 12, 1995****Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 271,969, Jul. 8, 1994, abandoned.

Foreign Application Priority Data

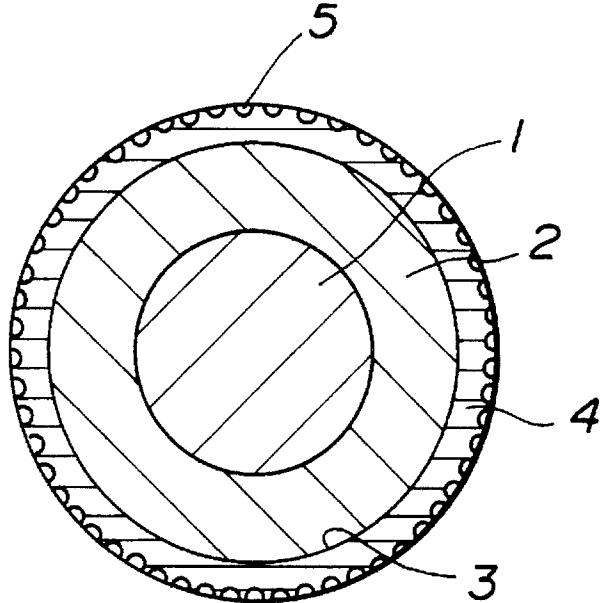
Jul. 8, 1993 [JP] Japan 5-193066

[51] Int. Cl.⁶ A63B 37/06; A63B 37/12;
A63B 37/14

[52] U.S. Cl. 473/365; 473/384

[58] Field of Search 473/356, 357,
473/358, 362, 364, 365, 366, 383, 384,
359; 273/222-227**[56]****References Cited****U.S. PATENT DOCUMENTS**5,338,034 8/1994 Cadormiga 473/365 X
5,467,994 11/1995 Moriyama et al. 473/365 X*Primary Examiner*—George J. Marlo*Attorney, Agent, or Firm*—Sughrue, Mion, Zinn, Macpeak & Seas**[57]****ABSTRACT**

A thread-wound golf ball includes a wound core (3) consisting of a center (1) and a thread rubber layer (2) thereon, and a cover (4) having a plurality of dimples (5). The core (3) wherein the thread rubber layer (2) has a thickness of 5 to 9 mm and a larger weight than the center (1) is enclosed in the cover (4) made of an ionomer resin having a thickness of 1 to 2.5 mm and a Shore D hardness of 52 to 68. The ball has an outer diameter of 42.9 to 46 mm. The total volume of dimples is 300 to 400 mm³. The ball having a relatively large diameter and an increased amount of thread rubber provides an increased flying distance and improved feeling on impact.

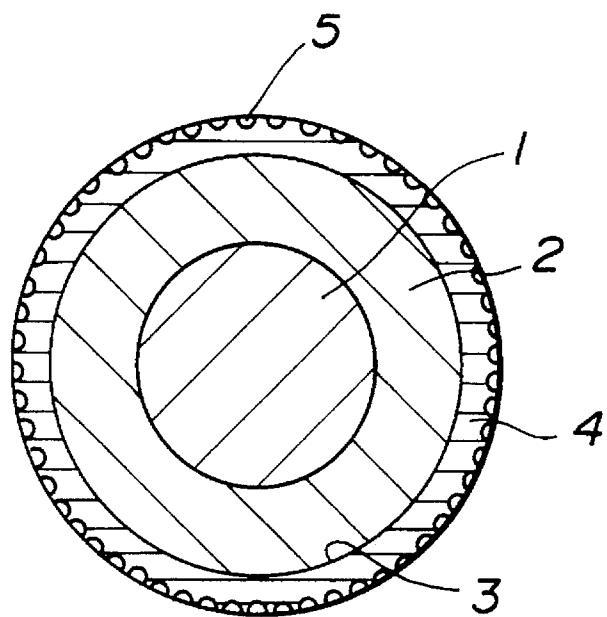
4 Claims, 1 Drawing Sheet

U.S. Patent

Mar. 11, 1997

5,609,532

FIG.1



5,609,532

1**THREAD-WOUND GOLF BALL****CROSS REFERENCE TO RELATED APPLICATION**

This application is a continuation-in-part of application Ser. No. 08/271,969 filed on Jul. 8, 1994, now abandoned, the entire contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

This invention relates to a thread-wound golf ball which is improved in flying distance and hitting feel.

2. Prior Art

The R&A Standards prescribe that golf balls shall have a diameter of at least 42.67 mm and a weight of at most 45.93 grams. The upper limit of diameter and the lower limit of weight are not specified. Any golf ball meets the Standards as long as it is 42.67 mm or larger in diameter and 45.93 grams or lower in weight.

However, in general practice, since it is desired for golf balls to reduce the aerodynamic resistance on trajectory for improving the flying performance, golf balls are manufactured such that they are small enough, but the ball diameter is not smaller than 42.67 and they are heavy enough, but the ball weight does not exceed 45.93 grams. More particularly, thread-wound golf balls are generally manufactured by winding thread rubber on a center having an outer diameter of 26 to 32 mm and a weight of 17 to 22 grams to form a wound core, which is covered with a resin to a thickness of 1.5 to 2.0 mm.

These wound golf balls are good in feeling and controllability, but they travel less distance when hit by less powerful players. Also undesirably, when hit off center, the wound balls are receptive to extra spin components like side spin, which detract from the flying distance.

A number of two-piece golf balls are now on the market. They are characterized by an increased flying distance as compared with the wound golf balls. This tendency becomes salient in slow head speed regions. With a choice of two-piece golf balls, less powerful players will be satisfied with an increased flying distance. However, the two-piece golf balls are poor in hitting feel because of hardness as compared with the wound golf balls and tend to roll further on the green because of minimized spin.

Therefore, golf balls which provide a pleasant feeling on impact and good control-lability like the wound golf balls and offer a substantial flying distance like the two-piece golf balls are desirable for less powerful golfers and golfers who swing at a low head speed.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a thread wound golf ball which offers a satisfactory flying distance and a pleasant feeling on impact even when hit by less powerful players.

In connection with a thread wound golf ball in which a wound core consisting of a center and a thread rubber layer is enclosed by a cover having a plurality of dimples thereon, the inventors have found that when the thread rubber layer has a thickness of 5 to 9 mm and a greater weight than the center, preferably by a weight difference of 0.1 to 15 grams, and the cover of an ionomer resin having a Shore D hardness

2

of 52 to 68 is applied to the core to a thickness of 1 to 2.5 mm, and the ball has a larger outer diameter of 42.9 to 46 mm than the conventional large size balls and the total volume of dimples is 300 to 400 mm³, there are achieved substantial improvements in flying distance and hitting feel.

In general, as the outer diameter increases, the flying distance decreases due to aerodynamic resistance. By increasing the amount of thread rubber in response to an increase in outer diameter, there are achieved an increase of initial speed, a decrease of spin, and an increase of ejection angle, which are useful settings for increasing the flying distance. By increasing the proportion of the thread rubber layer so that the thread rubber layer has a thickness of 5 to 9 mm and a larger weight than the center of the core and by adjusting the total volume of dimples to 300 to 400 mm³, not only repulsion is improved, which is effective for increasing the flying distance that the ball covers when hit at low head speeds, but also hitting-feel is substantially improved over the conventional wound golf balls having an ionomer resin cover. Balls having a larger outer diameter than the conventional golf balls are unlikely to sink in the grass, are easier to aim at, and produce a greater inertia moment so that the balls roll in a stable path on putting.

According to the present invention, there is provided a thread-wound golf ball comprising a wound core consisting of a center and a thread rubber layer thereon, and a cover enclosing the core and having a plurality of dimples thereon. The thread rubber layer has a thickness of 5 to 9 mm and a greater weight than the center of the core. Preferably, the thread rubber layer is heavier than the center portion of the core by 0.1 to 15 grams, more preferably by 1 to 10 grams. The cover is made of an ionomer resin and has a thickness of 1 to 2.5 mm and a Shore D hardness of 52 to 68. The ball has an outer diameter of 42.9 to 46 mm, preferably 44 to 46 mm. The total volume of dimples is 300 to 400 mm³.

BRIEF DESCRIPTION OF THE DRAWINGS

The sole figure, FIG. 1 is a schematic cross section of a thread-wound golf ball.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, the thread-wound golf ball of the invention includes a wound core 3 including a generally spherical center portion 1 and a thread rubber layer 2 enclosing the outer surface of the center portion 1. A cover 4 encloses the wound core 3 and has a plurality of dimples 5. According to the invention, the thread rubber layer 2 is heavier than the center portion 1 of the wound core 3.

The center 1 may be either a solid center or a liquid center. The preferred solid center is a solid rubber core and the preferred liquid center is a liquid center in the form of a vulcanized rubber bag filled with liquid.

The rubber used in the solid center is preferably a high cis polybutadiene rubber having high repulsion though not limited thereto. For example, the solid center is prepared by kneading 100 parts by weight of high cis polybutadiene rubber, 1 to 3 parts by weight of organic peroxide, and an appropriate amount of a weight control agent in a Banbury mixer or roll mill, and molding and vulcanizing the mix at 155° to 165° C. for 10 to 25 minutes. The vulcanizing agent used herein may be sulfur instead of the organic peroxide. Any of weight control agents, for example, zinc oxide, barium sulfate, silica, and calcium carbonate and mixtures thereof may be used.

5,609,532

3

Also useful is a liquid center which is generally prepared by forming a bag of conventional vulcanized rubber and filling the bag with water or a paste obtained by adding barium sulfate and a minor amount of ethylene glycol to water. The vulcanized rubber bag is preferably 1.5 to 2.5 mm in gage.

The center **1**, which is formed lighter than thread rubber layer **2**, preferably has a weight of 8 to 18 grams, more preferably 11 to 16 grams though not limited thereto. With a center weight of more than 18 grams, it would be difficult to construct a golf ball meeting the weight requirement. For a center weight of less than 8 grams, a choice of center material is limited and it is sometimes difficult to form such an extremely light center. When it is desired to form a center having a diameter of about 26 mm, for example, a center material having a specific gravity of less than 0.9 must be used in order that the center weight be less than 8 grams. It is then quite difficult to form such a center because most rubber materials conventionally used in the center have a specific gravity of more than 0.9. The center portion **1** may have a diameter of 24 to 32 mm, especially 26 to 30 mm.

The thread rubber layer **2** is formed by winding thread rubber around the outer periphery of the center portion **1** under high tension. The thread rubber layer **2** has a larger weight than the center portion **1**. Preferably the thread rubber layer has a weight of 16 to 26 grams, especially 17 to 22 grams. If the thread rubber layer is lighter than 16 grams, the entire ball would have a too lower weight to provide flying performance because the center is lighter than the thread rubber layer. If the thread rubber layer is heavier than 26 grams, it would be difficult to construct a golf ball meeting the weight requirement. The thread rubber layer has a radial thickness of 5 to 9 mm, especially 6 to 7 mm. The thread rubber layer forms with the center the wound core which may have an outer diameter of 39 to 43 mm. The thread rubber used in the thread rubber layer may be conventional one used in golf balls.

In the wound core **3** consisting of the center portion **1** and the thread rubber layer **2**, the weight of the thread rubber layer **2** is greater than the weight of the center portion **1** preferably by a weight difference of 0.1 to 15 grams, especially 0.3 to 10 grams. With a weight difference of less than 0.1 gram, repulsion would be low whereas with a weight difference of more than 15 grams, it would be difficult to construct a golf ball meeting the weight requirement. When a ball having an outer diameter of 44 to 46 mm is desired, the weight difference should preferably be 1 to 10 grams because an increase in flying distance is ensured.

On the wound core **3**, the cover **4** of ionomer resin is applied to a radial thickness of 1 to 2.5 mm, preferably 1.2 to 2.3 mm to complete a wound golf ball according to the invention. A cover of less than 1 mm thick is less resistant against cut and tends to be torn when hit at the top by iron shots. With a thickness of more than 2.5 mm, the cover is too thick and provides a hard touch to detract from hitting feel. The ionomer resin of which the cover **4** is formed may be conventional one used in golf ball covers, although ionomer resins having a Shore D hardness of 52 to 68 are preferred so that the cover has a Shore D hardness of 52 to 68, especially 54 to 65. With a Shore D hardness of less than 52, a flying distance would be lowered. Exemplary ionomer resins are Surlyn 1557, 1605, 1555 and 1706 commercially available from E.I. dupont. They may be used alone or in admixture of two or more.

The wound golf ball is completed by covering the wound core **3** with the ionomer resin cover **4** while forming dimples

5**4**

in the cover. The dimples may be distributed in any of geometrical arrangements including 8-sided and 20-sided polygonal patterns. The dimples may be of any desired shape including square, hexagon, pentagon, and triangle shapes.

The number of the dimples is preferably 300 to 500, more preferably 360 to 460. Each dimple may preferably has a diameter of 2.0 to 4.2 mm, especially 2.6 to 4.0 mm and a depth of 0.16 to 0.24 mm, especially 0.18 to 0.22 mm.

The total volume of the dimples is 300 to 400 mm³, more preferably 320 to 380 mm³. If the total volume of the dimples is less than 300 mm³, the flying distance is lowered because of a higher trajectory. If the total volume of the dimples is more than 400 mm³ the flying distance is lowered because of a lower trajectory.

By combining the center portion **1**, thread rubber layer **2** and cover **4** as mentioned above, the wound golf ball is completed to an outer diameter of 42.9 to 46 mm, preferably 43 to 46 mm, more preferably 43.5 to 46 mm. If the outer diameter exceeds 46 mm, it is sometimes difficult to limit the total weight within the weight requirement. If the outer diameter is less than 42.9 mm, the golf ball has substantially the same size as in the conventional ones and therefore the object of the present invention is not attained. The golf ball may have a total weight of 44.8 to 45.93 grams though not limited thereto.

The thread-wound golf ball of the invention offers a satisfactory flying distance and a pleasant feeling on impact even when it is hit by less powerful players who swing at a slow head speed. The ball is unlikely to sink in the grass, is easier to aim at, and produces a greater inertia moment to ensure stable rolling on putting.

35

EXAMPLE

Examples of the present invention are given below by way of illustration and not by way of limitation.

It is to be noted that the outer diameter of a golf ball is the diameter if the ball has true sphericity. As is well known in the art, it is very difficult to manufacture truly spherical balls and most golf balls have more or less distortion. In the following Examples and Comparative Examples, the outer diameter was measured at five pairs of points on the ball excluding dimples and an average of five measurements was calculated. The weight difference between the center and the thread rubber was determined by measuring the weights of the wound core (consisting of center and thread rubber layer) and the center and calculating from the difference.

55

Example 1

A mixture of high cis polybutadiene rubber/zinc white/zinc acrylate/barium sulfate/dicumyl peroxide in a weight ratio of 100/10/10/77/1.5 was fully milled and vulcanized at 160° C. for 20 minutes to form a solid center. Using this solid center, a 50/50 natural rubber/isoprene rubber mixture as thread rubber, and an ionomer resin (a 50/50 mixture of Surlyn 1706/Surlyn 1605, Shore D hardness 66 degrees) as a cover, wound golf balls were prepared to the specifications shown in Table 1. The golf balls were evaluated for MOI (inertia moment), coefficient of repulsion, flying characteristics, and hitting feel. The results are also shown in Table 1. The flying characteristics and hitting feel were measured and evaluated by the following tests.

5,609,532

5**Flying characteristics**

Using a swing robot manufactured by True Temper Co., the ball was hit by a driver (W1, loft 10°) at a head speed of 40 m/s to measure a carry and a total flying distance. Under these hitting conditions, initial speed, ejection angle and spin were measured.

Feeling

A blind test was made by professional golfers who hit the ball with W#1 and evaluated the feeling at impact.

Example 2

A mixture of high cis polybutadiene rubber/zinc white/zinc acrylate/barium sulfate/dicumyl peroxide in a weight ratio of 100/10/10/33/1.5 was fully milled and vulcanized at 160° C. for 20 minutes to form a solid center. By the same procedure as in Example 1 except that this solid center was used, wound golf balls were prepared to the specifications shown in Table 1. The golf balls were similarly evaluated, with the results shown in Table 1.

20

Example 3

A mixture of high cis polybutadiene rubber/zinc white/zinc acrylate/dicumyl peroxide in a weight ratio of 100/5.5/10/1.5 was fully milled and vulcanized at 160° C. for 20 minutes to form a solid center. By the same procedure as in Example 1 except that this solid center was used, wound golf balls were prepared to the specifications shown in Table 1. The golf balls were similarly evaluated, with the results shown in Table 1.

30

Example 4

A mixture of high cis polybutadiene rubber/zinc white/zinc acrylate/barium sulfate/dicumyl peroxide in a weight ratio of 100/5/10/5/1.5 was fully milled and vulcanized at 160° C. for 20 minutes to form a solid center. By the same procedure as in Example 1 except that this solid center was used, wound golf balls were prepared to the specifications shown in Table 1. The golf balls were similarly evaluated, with the results shown in Table 1.

40

Example 5

As in Example 2, golf balls were prepared to the specifications shown in Table 1. The golf balls were similarly evaluated, with the results shown in Table 1.

35

45

6**Examples 6 and 7**

A liquid center was prepared by milling a mixture of natural rubber/zinc white/stearic acid/sulfur/vulcanization accelerator/antioxidant in a weight ratio of 100/35/2/2/1.5/1 to form a soft vulcanizable rubber blend having a specific gravity of about 1.18 as a sheet of about 2 mm thick and shaping it into a pair of semi-vulcanized semi-spherical cups having a diameter of about 28 mm. Barium sulfate and ethylene glycol were added to water to form a paste. The semi-spherical cups were mated to form a sphere which was filled with the paste. The cups were welded together and vulcanized in a mold.

By the same procedure as in Example 1 except that this liquid center was used, wound golf balls were prepared to the specifications shown in Table 1. The golf balls were similarly evaluated, with the results shown in Table 1.

10

15

Example 8

The golf ball was prepared in the same procedure as in Example 1 except that the hardness of the cover and the total volume of the dimples were changed as shown in Table 1.

Comparative Examples 1-5

Wound golf balls were similarly prepared in which the center was heavier than the thread rubber and the ball outer diameter was less than 42.9 mm. The golf balls were similarly evaluated, with the results shown in Table 1. Note that Comparative Examples 2 and 3 were commercially available golf balls which were disassembled to measure the weight of thread rubber and center. Comparative Examples 1-3 and 5 had a solid center and Comparative Example 4 had a liquid center.

Comparative Examples 6-8

The golf balls were prepared in the same procedure as in Example 1 except that the hardness of the cover and the total volume of the dimples were changed as shown in Table 1.

TABLE 1

	Example								Comparative Example							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
<u>Center</u>																
Type	solid	solid	solid	solid	solid	liquid	liquid	solid	solid	solid	solid	liquid	solid	solid	solid	solid
Diameter(mm)	27.6	27.6	27.6	30.0	27.6	27.8	27.8	27.6	27.6	30.2	31.5	27.8	32.0	27.6	27.6	27.6
Weight(gram)	16.7	14.2	14.0	14.4	14.2	16.6	11.9	16.7	17.5	20.5	21.6	17.6	19.6	16.7	16.7	16.7
Wound core																
Diameter(mm)	39.6	40.6	40.2	41.6	40.6	39.6	41.6	39.6	39.2	39.0	39.0	39.3	40.4	39.6	39.6	39.6
Weight(gram)	34.1	33.7	32.3	33.2	33.7	34.1	33.3	34.1	34.1	34.6	35.8	34.4	33.2	34.2	34.1	34.1
Weight difference*(gram)	0.7	5.3	4.3	4.4	5.3	0.9	9.5	0.7	-0.9	-6.4	-7.4	-0.8	-6.0	0.8	0.7	0.7
Cover																
Shore D hardness (degree)	66	66	66	66	58	66	67	54	66	66	66	67	66	50	66	66

5,609,532

7

8

TABLE 1-continued

	Example								Comparative Example								
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	
Thickness Dimple	1.8	1.8	2.0	1.8	1.8	1.9	1.9	1.8	1.8	2.0	2.0	1.9	1.8	1.8	1.8	1.80	
Total volume (mm ³)	320	340	360	380	340	320	380	360	320	360	320	320	360	320	280	420	
Completed ball																	
Diameter(mm)	43.0	44.0	44.0	45.0	44.0	43.0	45.0	43.0	42.7	42.7	42.7	42.7	44.0	43.0	43.0	43.0	
Weight(gram)	45.3	45.3	45.4	45.3	45.3	45.2	45.4	45.2	45.2	45.4	45.6	45.3	45.3	45.4	45.3	45.3	
Hardness(mm)	2.80	2.90	2.80	2.80	2.95	2.80	2.70	2.83	2.85	2.80	2.75	2.80	2.73	2.85	2.80	2.80	
MOI, g · cm ²	79.12	87.70	86.12	93.14	85.59	79.13	92.85	79.10	76.99	78.51	78.90	76.02	87.70	79.15	79.12	79.12	
Coefficient of repulsion	0.786	0.789	0.789	0.791	0.783	0.783	0.783	0.771	0.778	0.772	0.764	0.772	0.771	0.755	0.786	0.786	
Flying characteristics																	
Initial speed(m/s)	59.8	59.9	59.9	60.0	59.8	59.8	59.8	59.8	59.3	59.6	59.4	59.1	59.4	59.2	59.0	59.8	29.9
Ejection angle(degree)	10.3	10.3	10.3	10.4	10.3	10.5	10.6	10.3	10.0	10.2	9.7	10.1	10.1	9.9	10.3	10.3	
Spin(rpm)	3200	3170	3140	3110	3250	3130	3080	3350	3440	3350	3800	3300	3380	3750	3180	3210	
Elevation angle(degree)	12.1	12.3	12.1	12.2	12.4	12.0	12.3	12.0	12.5	11.8	12.7	12.4	11.7	12.8	12.7	11.7	
Carry(m)	180.8	182.1	181.5	182.3	181.6	180.3	183.1	180.5	178.1	179.3	176.0	176.5	177.4	175.5	175.2	176.3	
Total(m)	196.3	196.8	198.0	197.4	194.0	197.0	197.5	196.0	191.6	193.2	187.8	192.6	191.3	187.2	190.3	191.5	
Feeling	good	good	good	good	good	good	good	good	fair	hard	hard	fair	hard	good	good	good	

*weight difference = thread rubber layer - center

As is evident from Table 1, the wound golf balls of the invention are characterized by an improved feeling on impact, an increased coefficient of repulsion, an increased initial speed, a high ejection angle, and controlled spin so that they travel along a trajectory approximate to two-piece golf balls to provide an increased flying distance. They also give a soft feeling, contrary to the known fact that solid center wound golf balls are hard on hitting and in this regard resemble to two-piece golf balls.

The thread-wound golf ball of the invention in which the ball is enlarged to a diameter of 42.9 to 46 mm to allow the thread rubber content to be increased achieves an increase of flying distance through improved repulsion, an increased initial speed, reduced spin, and an increased ejection angle. The ball offers a satisfactory flying distance and a pleasant feeling on impact even when it is hit by less powerful players who swing at a slow head speed. The ball is unlikely to sink in the grass and is easier to hit.

Although some preferred embodiments have been described, many modifications and variations may be made thereto in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims,

the invention may be practiced otherwise than as specifically described.

I claim:

1. A thread-wound golf ball comprising a wound core consisting of a center and a thread rubber layer thereon, and a cover enclosing the core and having a plurality of dimples thereon, wherein the thread rubber layer has a thickness of 5 to 9 mm and a larger weight than the center of said core, said cover is made of an ionomer resin and has a thickness of 1 to 2.5 mm and a Shore D hardness of 52 to 68, and the ball has an outer diameter of 42.9 to 46 mm and the total volume of dimples of 300 to 400 mm³.

2. The golf ball of claim 1 wherein the thread rubber layer is heavier than the center of said core by 0.1 to 15 grams.

3. The golf ball of claim 2 wherein the ball has an outer diameter of 44 to 46 mm and the thread rubber layer is heavier than the center of said core by 1 to 10 grams.

4. The golf ball of claim 1 wherein the center has a weight of 8 to 18 grams and a diameter of 24 to 32 mm, and the thread rubber layer has a weight of 16 to 26 grams and a thickness of 5 to 9 mm.

* * * * *

Exhibit E



US005496034A

United States Patent [19]**Maruko et al.****[11] Patent Number:** **5,496,034****[45] Date of Patent:** **Mar. 5, 1996****[54] THREAD WOUND GOLF BALL****[75] Inventors:** **Takashi Maruko; Shinichi Kakiuchi,**
both of Yokohama, Japan

5,328,959	7/1994	Sullivan	273/235 R X
5,338,038	8/1994	Cadorniga	273/231 X
5,368,304	11/1994	Sullivan et al.	273/235 R X
5,415,937	5/1995	Cadorniga et al.	273/235 R X

[73] Assignee: **Bridgestone Sports Co., Ltd., Tokyo,**
Japan

Primary Examiner—George J. Marlo
Attorney, Agent, or Firm—Sughrue, Mion, Zinn, Macpeak & Seas

[21] Appl. No.: **352,633****[22] Filed:** **Dec. 9, 1994****[30] Foreign Application Priority Data**

Dec. 9, 1993 [JP] Japan 5-340861

[51] Int. Cl.⁶ **A63B 37/08; A63B 37/12****[52] U.S. Cl.** **273/216; 273/227; 273/231;**
273/235 R; 273/DIG. 22**[58] Field of Search** 273/231, 235 R,
273/222, 226, 227, 228, 230, DIG. 22,
216**[57]****ABSTRACT**

A thread-wound golf ball having a liquid center wound by rubber thread and further having a cover placed thereon, characterized by using as the major component of the cover an ionomer whose JIS-C hardness is 70–85, making the thickness of the cover 1.0–1.8 mm, making the outside diameter of the liquid center 27–30 mm, making the center bag hardness of the liquid center 44–62 (in terms of JIS-A hardness), and making the thickness of the center bag 1.8–2.3 mm.

[56] References Cited**U.S. PATENT DOCUMENTS**

5,033,749 7/1991 Kakiuchi et al. 273/231 X

1 Claim, No Drawings

1**THREAD WOUND GOLF BALL****BACKGROUND OF THE INVENTION****1. Field of the Invention**

The present invention relates to a thread-wound golf ball having its liquid center wound by rubber thread and further having a cover placed thereon.

2. Description of the Prior Art

Among the thread-wound golf balls are the one having its center wound by rubber thread and having a cover placed thereon and the one having its solid center wound by rubber thread and having a cover placed thereon, and each is divided into thread-wound balata ball and thread-wound Surlyn ball according to the kind of the cover material.

The thread-wound balata ball that uses balata as the cover material is superior in controllability and hit sense but, as compared with the thread-wound Surlyn ball that uses ionomer resin as the cover material, has a larger spin amount, a smaller run, and as the result, is poor in fly distance, and the durability of the cover is also inferior.

On the other hand, the thread-wound Surlyn golf ball is superior in the durability of the cover, but is inferior in hit sense, has a small spin amount, and is inferior in controllability.

The present invention was worked out in view of the foregoing circumstances, and is intended to provide a thread-wound golf ball with a liquid center which gives an adequate spin characteristics and as good a hit sense as the thread-wound balata ball, and maintains the inherent durability and fly distance of the thread-wound Surlyn ball.

SUMMARY OF THE INVENTION

The present inventors carried out extensive studies to achieve the above-mentioned object, and as the result, found that the thread-wound golf ball having the intended performance as mentioned above is obtained by using as the major component of the cover an ionomer resin whose JIS-C hardness is 70-85, making the thickness of the cover 1.0-1.8 mm, making the outside diameter of the liquid center 27-30 mm, making the center bag hardness of the liquid center 44-62 (in terms of JIS-A hardness), and making the thickness of the center bag 1.8-2.3 mm in a thread-wound golf ball having its liquid center wound by rubber thread and having a cover placed thereon.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For the improvement of the fly distance of the driver etc., the one with less spin is advantageous because the trajectory of the ball is not too high and the rolling (run) after dropping increases. On the other hand, as to controllability, the one having much spin is advantageous because the stopping of the ball on the green is good. Thus the spin performance is important for the performance of the golf ball, but this spin performance is determined by the degree of deformation of the ball at the time of hit and the frictional force between the ball and the club face. In the case where the impact force to the ball is large like driver shot, the amount of deformation of the ball is dominant; and on the other hand, in the case where the impact force to the ball is small like approach shot, the frictional force between the ball and the club face is dominant. The present inventors noticed this point and studied the specifications of the cover material and liquid center so that the spin is smaller than the conventional

thread-wound balata ball in the shots of drivers etc. and the spin is equal in the shots of short iron etc. As the results, they found that if the hardness and thickness of the cover material are prescribed to the above-mentioned specific values and the diameter and hardness of the liquid center and the thickness of the center bag are made adequate as mentioned above, the spin performance to give a good fly distance and controllability can be obtained and the good cut resistance can be obtained, and reached the present invention.

10 Therefore, the present invention provides a thread-wound golf ball having a liquid center wound by rubber thread and further having a cover placed thereon, characterized by using as the major component of the cover an ionomer whose JIS-C hardness is 70-85, making the thickness of the cover 1.0-1.8 mm, making the outside diameter of the liquid center 27-30 mm, making the center bag hardness of the liquid center 44-62 (in terms of JIS-A hardness), and making the thickness of the center bag 1.8-2.3 mm.

20 In the following, the present invention will be described in more detail, and the thread-wound golf ball of the present invention is composed of a liquid center, rubber thread, and cover.

The liquid center herein is one having the center bag filled with a liquid such as water and further with a weight adjusting agent such as barium sulfate, and its specific gravity should be 1.0-2.0, preferably 1.0-1.7.

25 On the other hand, as the material of the center bag, the bag rubber of liquid center ball for the ordinary golf ball, for example, natural rubber, butadiene rubber, isoprene rubber, or a mixture rubber thereof, incorporated with stearic acid, zinc white, oil, sulfur, and vulcanizer, is used for forming, but in the present invention, the outside diameter of this center bag is 27-30 mm and the thickness is 1.8-2.3 mm, and the JIS-A hardness is 44-62, preferably 48-58. If the outside diameter of the center bag is smaller than 27 mm, too much spin is experienced, and conversely, if larger than 30 mm, spin is hardly experienced, and moreover, in order to gain an adequate ball hardness, it is necessary to wind by heightening the tension of the rubber thread, and the thread breakage is increased by this and hence the working efficiency decreases. Also, if the thickness of the center bag is thinner than 1.8 mm, the strength is weak and if thicker than 2.3 mm, the hardness of the center bag is too large and excessive spin is experienced, and the object of the present invention is not achieved. Moreover, if the JIS-A hardness of the center bag is smaller than 48, the amount of back spin is too little, especially the controllability in iron shot decreases; and conversely, if it is greater than 62, too much spin is experienced in shot by the driver and this leads to a decrease in fly distance.

30 There are no specific restrictions on the material of the rubber thread to be wound on the above-mentioned liquid center, and it is possible to use ordinary rubber thread such as crumb rubber thread produced by kneading solid rubber and IR latex thread rubber produced from isoprene rubber (IR) latex.

35 The thread-wound golf ball of the present invention is one in which the rubber thread like this is wound under tension around the above-mentioned liquid center, thereby forming the rubber thread layer. In this case, if the thickness direction of the rubber thread coincides with the radical direction, the winding method is not restricted, and it is possible to wind by any known method such as random winding (or basket winding) and great circle winding, and it is possible to carry out the winding step by using any known automatic winding machine according to the winding method. Incidentally, the

degree of elongation of rubber thread at the time of winding is usually 8–10 times, depending on the cross-sectional area of the rubber thread, and it is possible to set up an ordinary thickness for the thickness of the rubber thread layer according to the diameter of the center and the size of the ball (whether large ball or small ball).

In the present invention, as the cover covering this rubber thread layer, one whose major component is ionomer resin is used. As this ionomer resin, one in which at least part of the carboxylic acid groups in a binary copolymer of olefin and unsaturated carboxylic acid or a ternary copolymer of olefin, unsaturated carboxylic acid, and unsaturated carboxylic ester is neutralized with metal ions is used, and above all one in which at least part of carboxylic acid groups of a copolymer in which ethylene is used as an olefin and acrylic acid/methacrylic acid is used as an unsaturated carboxylic acid is neutralized with metal ions is preferably used.

To be concrete, those in which at least part of carboxylic acid groups of ethylene-(meth)acrylic acid copolymer and ethylene-(meth)acrylic acid-(meth)acrylic ester terpolymer is neutralized with metal ions are enumerated. As the metal, Li, N, K, Zn, etc. are used.

In the present invention, the cover is formed by using this ionomer as the major component, but in this case, it is possible to form the cover by incorporating thermoplastic resins etc. such as EVA, EAA, and polyester elastomer, according to need.

In the present invention, the above-mentioned cover should be such that its JIS-A hardness is 70–85, preferably 76–82, and its thickness is 1.0–1.8 mm. If the JIS-A hardness is smaller than 70, the resilience performance decreases, and if larger than 85, spin is hardly experienced. Also, if the cover thickness is thinner than 1.0 mm, the cut resistance decreases, and if thicker than 1.8 mm, spin is hardly experienced, and the initial velocity of the ball decreases.

The golf ball of the present invention is formed such that its overall diameter is usually 42.67 mm or so and its weight is 45.2 g or so.

EXAMPLES

In the following, the invention will be explained concretely with reference to Examples and Comparative Examples, but the invention is not restricted to the following examples.

Examples 1–5 & Comparative Examples 1–8

First, as the center bag material, one in which zinc, naphthalene oil, vulcanization accelerator, and sulfur are added to natural rubber was used, and the liquid center of the specification as shown in Table 1 was prepared.

Further, in the production of the center bag, its specific gravity and hardness were adjusted by controlling the compounding amount of zinc white.

TABLE 1

Center diam- eter (mm)	Center weight (g)	Center bag			Liquid	
		Hard- ness	Gauge	Sp. Gr.	Compound- ing	Sp. Gr.
A	28.0	17.8	48	2.0	1.34	Water Barium
					1.65	

TABLE 1-continued

Center diam- eter (mm)	Center weight (g)	Center bag			Liquid	
		Hard- ness	Gauge	Sp. Gr.	Compound- ing	Sp. Gr.
B	29.0	18.7	56	2.3	2.23	sulfate Water
C	28.0	17.8	62	2.3	2.33	Water
D	28.0	16.8	48	2.0	1.17	Water Barium sulfate

Then, using crumb rubber thread as the rubber thread and winding around the above-mentioned liquid center by the ordinary thread winding method, the thread-wound core of the outside diameter shown in Table 2 was obtained.

On the other hand, covering the above-mentioned thread-wound core with a pair of half-shells formed by using a compound in which 5 parts by weight of titanium oxide was added to 100 parts by weight of the following ionomer resin (Himiran, Mitsui DuPont Chemical Co., Ltd.), and heat-compression molding at 140° C. for 5 minutes, the thread-wound golf balls in which the following covers A to E were formed were obtained.

Cover A

Himiran 1706/Himiran 1605=50/50 (weight ratio)

Cover hardness JIS-C 92

Cover B

Himiran 1557/Himiran 1856=75/25 (weight ratio)

Cover hardness JIS-C 89

Cover C

Himiran 1557/Himiran 1856=50/50 (weight ratio)

Cover hardness JIS-C 84

Cover D

Himiran 1650/Himiran 1856=40/60 (weight ratio)

Cover hardness JIS-C 78

Cover E

Himiran 1557/Himiran 1855/Himiran 1856=10/40/50 (weight ratio)

Cover hardness JIS-C 76

Also, for the purpose of comparison, the above-mentioned thread-wound core was covered with a pair of half-shells formed from the compound (balata cover material) of the following recipe

parts by weight	
trans-1,4-polyisoprene	70
high styrene resin	20
natural rubber	10
zinc white	10
titanium oxide	10
stearic acid	1.0
sulfur	1.5

and, after heat compression molding at about 85° C. for 10 minutes, it was cured, and the thread-wound golf ball having the following cover F was produced.

Cover F

balata cover

cover hardness JIS-C 76

Then, the performance of the obtained golf balls was evaluated. The results are shown in Tables 2 and 3.

5,496,034

5**6**

TABLE 2

	Example						
	1	2	3	4	5		
Cover	E	E	D	C	E		
Liquid center	Hardness (JIS-C)	76	76	78	84	76	
	Thickness (mm)	1.34	1.59	1.34	1.34	1.34	
Golf ball	A	A	A	B	B		
	Outside diameter (mm)	28.0	28.0	28.0	29.0	29.0	
	Weight (g)	17.8	17.8	17.8	17.8	18.7	
	Bag gauge (mm)	2.0	2.0	2.0	2.3	2.3	
	Bag hardness (JIS-A)	48	48	48	56	56	
	Thread-wound core outside diameter	40.0	40.5	40.0	40.0	40.0	
	W #1 HS = 45	Initial velocity (m/s)	66.1	66.3	66.1	66.2	66.1
	S/W HS = 20	Spin (rpm)	3070	3120	3000	3100	3180
	Cut resistance	6450	6600	6300	6350	6750	
		320	200	340	360	320	

TABLE 3

	Comparative Example								
	1	2	3	4	5	6	7	8	
Cover	A	A	A	B	E	B	B	F	
Liquid center	Hardness (JIS-C)	92	92	92	89	76	89	89	76
	Thickness (mm)	1.59	1.34	1.09	1.59	1.59	1.59	1.59	1.09
Golf ball	A	C	C	C	C	A	B	D	
	Outside diameter (mm)	28.0	28.0	28.0	28.0	28.0	29.0	28.0	28.0
	Weight (g)	17.8	17.8	17.8	17.8	17.8	17.8	18.7	16.8
	Bag gauge (mm)	2.3	2.3	2.3	2.3	2.3	2.0	2.3	2.0
	Thread-wound core outside diameter	39.5	40.0	40.5	39.5	39.5	39.5	39.5	40.5
	W #1 HS = 45	Initial velocity (m/s)	66.2	66.3	66.4	65.9	65.8	65.9	66.0
	S/W HS = 20	Spin (rpm)	2800	2880	2950	2980	3280	2900	2950
	Cut resistance	4800	4990	5180	5350	6690	5150	5320	6650
		500	360	280	470	420	490	490	100

* Cut resistance:

Using a No. 9 iron, the center of each 20 balls was hit at a head speed of 30 m/s, and the number of the balls which were not cut was counted. In this case, the index was given, the number in Comparative Example 8 being as 100.

* Golf ball hardness:

Amount of deformation of ball at the time of 100 kg load (mm).

* Initial velocity:

The hit velocity of the ball when hit using W#1 (driver) at a head speed of 45 m/s. An average value of n=12 was taken.

* Spin:

The amount of spin when hit at HS (head speed, m/s) in the Table using W#1, S/W (sand wedge). An average value of n=12 was taken.

EFFECT OF THE INVENTION

The thread-wound golf ball of the present invention has a little spin and a great fly distance in the shot by the driver etc. and has good spin characteristics in approach shot, and yet is superior in cut resistance. Japanese Patent Application No. 5-340861 is incorporated herein by reference.

What is claimed is:

1. A thread-wound golf ball having a liquid center wound by rubber thread and further having a cover placed thereon, wherein the major component of the cover is an ionomer whose JIS-C hardness is 70-85, and wherein the thickness of the cover is 1.0-1.8 mm, the outside diameter of the liquid center is 27-30 mm, the center bag hardness of the liquid center, in terms of JIS-A hardness, is 44-62, and the thickness of the center bag is 1.8-2.3 mm.

* * * * *

Exhibit F

CONFIDENTIAL EXHIBIT

Exhibit G

MAY 25 2004
OFFICIAL

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: S. WU *et al.*

Attorney Docket No: 20002.0263

Application No.: 10/256,011

Group Art Unit: 1712

Filed: September 27, 2002

Examiner: D. Buttner

For: THIN LAYER-COVERED GOLF BALL WITH
IMPROVED VELOCITY

RESPONSE TO OFFICE ACTION

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Sir:

In response to the office action mailed February 25, 2004, Applicants submit the following amendments and remarks for entry and consideration during the examination of the above-identified application.

IN THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A golf ball comprising:
a center comprising a material formed from the conversion reaction of at least a cis-to-trans catalyst and a polybutadiene, wherein the material has a molecular weight of greater than about 200,000 and a resilience index of at least about 40;
an inner cover layer; and
an outer cover layer disposed about the inner cover layer comprising a polyurethane composition.
2. (Original) The golf ball of claim 1, wherein the inner cover layer comprises at least one of an ionomer resin, a polyurethane, a polyetherester, a polyetheramide, a polyester, a dynamically vulcanized elastomer, a functionalized styrenebutadiene elastomer, a metallocene polymer nylon, acrylonitrile butadiene-styrene copolymer, or blends thereof.
3. (Currently Amended) The golf ball of claim 1, wherein the resilience index of the material is at least about [[40]] 50.
4. (Original) The golf ball of claim 1, wherein the cis-to-trans catalyst comprises at least one of an organosulfur compound, an inorganic sulfur compound, an aromatic organometallic compound, a metal-organosulfur compound, tellurium, selenium, elemental sulfur, a polymeric sulfur, or an aromatic organic compound.
5. (Original) The golf ball of claim 1, wherein the polyurethane composition comprises at least one isocyanate, at least one polyol, and at least one curing agent.
6. (Original) The golf ball of claim 1, wherein the outer cover layer has a thickness of about 0.02 inches to about 0.04 inches.
7. (Original) The golf ball of claim 1, wherein the inner cover layer has an outer diameter of

about 1.55 inches or greater.

8.-20. (Canceled)

21. (Currently Amended) A golf ball comprising:

a center formed of a reaction product comprising polybutadiene and a cis-to-trans catalyst, wherein the reaction product has a molecular weight of greater than about 200,000, and wherein the reaction product comprises greater than about 32 percent trans-isomer;

an inner cover layer;

an outer cover layer disposed around the inner cover layer, wherein the outer cover layer comprises a castable reactive liquid material.

22. (Original) The golf ball of claim 21, wherein the inner cover layer comprises an ionomer resin, a polyurethane, a polyetherester, a polyetheramide, a polyester, a dynamically vulcanized elastomer, a functionalized styrenebutadiene elastomer, a metallocene polymer nylon, acrylonitrile butadiene-styrene copolymer, or blends thereof.

23. (Original) The golf ball of claim 21, wherein the inner cover layer comprises a copolymer of ethylene and an unsaturated monocarboxylic acid, wherein the monocarboxylic acid is at least partially neutralized.

24. (Original) The golf ball of claim 23, wherein the monocarboxylic acid is fully neutralized.

25. (Original) The golf ball of claim 21, wherein the outer cover layer has a thickness of about 0.02 inches to about 0.04 inches and the inner cover layer has an outer diameter of about 1.55 inches or greater.

26. (Original) The golf ball of claim 21, wherein the castable reactive material comprises a prepolymer having less than about 14 percent unreacted isocyanate groups, and wherein the

prepolymer is cured with a polyol, polyamine, or a mixture thereof.

27. (Original) The golf ball of claim 21, wherein the cis-to-trans catalyst comprises at least one of an organosulfur compound, an inorganic sulfur compound, an aromatic organometallic compound, a metal-organosulfur compound, tellurium, selenium, elemental sulfur, a polymeric sulfur, or an aromatic organic compound.

28. (Original) The golf ball of claim 21, wherein the reaction product has a molecular weight of about 300,000 or greater.

Please add the following new claims:

29. (New) A golf ball comprising:

a center comprising a material formed from the conversion reaction of at least a cis-to-trans catalyst and a polybutadiene, wherein the material has a molecular weight of greater than about 200,000 and a resilience index of at least about 40;
an inner cover layer; and
an outer cover layer disposed about the inner cover layer comprising a castable reactive liquid material.

30. (New) The golf ball of claim 29, wherein the cis-to-trans catalyst comprises an organosulfur compound.

31. (New) The golf ball of claim 30, wherein the cis-to-trans catalyst is present in an amount sufficient to result in the material comprising greater than 32 percent trans-polybutadiene isomer.

32. (New) The golf ball of claim 31, wherein the cis-to-trans catalyst is present in an amount from about 0.1 to 5 parts per hundred based on the total material.

33. (New) The golf ball of claim 29, wherein the resilience index is at least about 50.

34. (New) The golf ball of claim 29, wherein the inner cover layer has a hardness of about 50

to about 75 Shore D.

35. (New) The golf ball of claim 29, wherein the castable reactive liquid material has a material hardness of about 30 Shore D to about 60 Shore D.

REMARKS

Claims 1-28, as amended, and new claims 29-35 are pending in this application. In this Response, Applicants have amended certain claims. In light of the Office Action, Applicants believe these amendments serve a useful clarification purpose, and are desirable for clarification purposes, independent of patentability. Accordingly, Applicants respectfully submit that the claim amendments do not limit the range of any permissible equivalents.

In particular, independent claim 1 has been rewritten to include the features previously recited in dependent claim 3. Claim 3 has been amended to further define the resilience index. Independent claim 21 has been rewritten to recite that the reaction product has a trans-polybutadiene isomer content of greater than about 32 percent, which is supported by the Specification at Page 17, lines 32-35.

New claims 29-35 have been added to recite additional embodiments of the present invention and are supported by the present Specification as follows:

Claim(s)	Support in Specification
29	Original claims 1-3, and 28 Page 25, line 33 to Page 26, line 2
30	Original claim 4
31	Page 17, lines 32-35
32	Page 19, lines 2-4
33	Page 32, lines 29-30
34	Page 34, lines 3-4
35	Page 33, line 27 to Page 34, line 3

As no new matter has been added, Applicants respectfully request entry of these amendments at this time.

RESTRICTION REQUIREMENT

In response to the Restriction Requirement imposed by the Examiner, the Applicant hereby confirms election of Group I (claims 1-7 and 21-28) for prosecution in this application. As a result of the present claim cancellations and additions, however, Group I now includes claims 1-7 and 21-35. In light of the cancellation of claims 8-20, Applicant respectfully submits that the Restriction Requirement is moot.

THE REJECTIONS UNDER 35 U.S.C. §§ 102 & 103Moriyama '396 Does Not Anticipate or Render Obvious the Present Invention

Claims 1-2, 4, and 6-7 were rejected under 35 U.S.C. § 102(e) as anticipated by or, in the alternative, under §103(a) as obvious over U.S. Patent No. 5,980,396 to Moriyama *et al.* for the reasons set forth on page 3 of the Office Action. In addition, claims 1-2 and 4-7 were rejected under § 103(a) as obvious over Moriyama '396 in view of U.S. Patent No. 6,117,024 to Dewanjee as provided on page 3 of the Office Action. Moriyama '396 alone, or in combination with Dewanjee, does not disclose or suggest the present invention for the reasons that follow.

The objective of Moriyama '396 is to provide long flight distance and good shot feel. Col. 1, lines 35-37. To achieve this objective, Moriyama '396 proposes a four-piece golf ball with a vulcanized rubber center, a thermoplastic or vulcanized outer core layer, a vulcanized rubber or thermoplastic intermediate layer, and a thermoplastic outer cover layer. See, e.g., Col. 2, lines 10-19 and 30-54. of Abstract. This selection of materials is arranged to provide a soft-hard-soft-hard from the center to the cover. Col. 2, lines 15-19.

Moriyama '396 is silent, however, as to the resilience index of the center material, as presently recited in independent claim 1 and new independent claim 29. One of ordinary skill in the art would not have been motivated to form the center presently recited from the teachings of Moriyama '396 without the improper use of hindsight. As such, Applicants respectfully submit that Moriyama '396 does not anticipate or render obvious the invention presently recited in claims 1-2, 4, and 6-7.¹

The Combination of Moriyama '396 and Dewanjee Does Not Render Obvious the Present Invention

Because Moriyama '396 does not disclose specific teaching regarding a polyurethane outer cover layer, the Examiner relies on Dewanjee for its disclosure of polyisocyanates, polyols, and curing agents. Dewanjee, however, does not cure the deficiencies of Moriyama '396 with respect to the resilience index now recited in independent claim 1. In fact, Dewanjee, like Moriyama '396, is completely silent as to a resilience index of the core material. Thus, Applicants respectfully submit

¹ It appears that the Examiner also recognizes the deficiencies of the cited references with respect to the resilience index of the center material in light of the absence of §§ 102 and 103 rejections of claim 3, as previously recited.

that the combination of Moriyama '396 and Dewanjee does not result in the present invention, nor does it render obvious the present invention.

For the reasons discussed above, Moriyama '396 alone, or in combination with Dewanjee, does not disclose or suggest the invention presently recited in independent claim 1, and those claims depending therefrom. Thus, Applicants respectfully request reconsideration and withdrawal of the §§ 102 and 103 rejections based on the cited references.

Sullivan and Moriyama '856 Do Not Render Obvious the Present Invention

The Examiner also rejected claims 1-2, 4, 6-7 and 21-28 under § 103(a) as obvious over U.S. Patent No. 6,210,293 to Sullivan in view of U.S. Patent No. 5,697,856 to Moriyama *et al.* for the reasons stated on pages 3-4 of the Office Action.

Similar to Moriyama '396, Sullivan does not disclose or suggest a center material with a resilience index as presently recited in independent claim 1. As above, it appears that the Examiner agrees with this assessment in light of the lack of substantive rejections of this subject matter (previously recited in dependent claim 3). Moriyama '856 does not remedy this deficiency because the reference also lacks any mention of the resilience index of the center material. In fact, the Examiner appears to rely on Moriyama '856 solely for its disclosure of catalyst. Office Action at Page 4).

Moreover, Sullivan does not disclose or suggest the invention recited in independent claim 21. Independent claim 21 now recites a reaction product having a trans-polybutadiene isomer content of greater than about 32 percent. Because Sullivan is completely silent as to a cis-to-trans catalyst, the Examiner has relied upon Moriyama '856 for its disclosure of catalyst. However, Moriyama '856 teaches that the trans structure after vulcanization *must* be within the range of 10 percent to 30 percent. Col. 3, lines 27-29 (emphasis added). In fact, the reference *teaches away* from the claimed amount of trans-polybutadiene isomer in stating that "when the amount of trans structure exceeds 30%, the core is too soft and the resilience performances are deteriorated." Col. 3, lines 31-33. Thus, one of ordinary skill in the art would have lacked any motivation to stray outside of the range disclosed in Moriyama '856 without the present invention to use as a template. As such, the combination of Sullivan and Moriyama '856 does not render obvious the invention presently recited in claim 21.

With regard to the Examiner's rejections of the claims depending from independent claims 1 and 21, Applicants respectfully submit that these claims are patentable at least by virtue of their dependency from allowable subject matter.

For the reasons set forth above, Applicants respectfully submit that no combination of Sullivan and Moriyama '856 discloses or suggests the present invention. Consequently, Applicants respectfully request reconsideration and withdrawal of the rejections based thereon.

THE DOUBLE PATENTING REJECTION

The Examiner rejected claims 1-7 and 21-28 under the judicially created doctrine of obviousness-type double patenting as obvious over claims 1-50 of the U.S. Patent No. 6,486,261 to Wu *et al.* Applicants submit herewith a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321(c) in order to overcome the double patenting rejections based on the Wu '261 patent. As such, Applicants respectfully request that the double patenting rejection be withdrawn.

NEW CLAIMS ADDED WITH THIS RESPONSE

Applicants respectfully submit that independent claim 29, and those depending therefrom, are allowable for similar reasons as discussed above. Like rewritten independent claim 1, independent claim 29 also recites a resilience index for the center material, which is lacking from the cited references.

Furthermore, the dependent claims are independently patentable. For example, dependent claim 31 recites a trans-polybutadiene isomer content of the reaction product of greater than about 32 percent. Neither Moriyama '396 nor Sullivan disclose or even suggest a trans-polybutadiene isomer content, as presently recited. Furthermore, as discussed above, Moriyama '856 teaches away from the claimed amount of trans-polybutadiene isomer content.

Therefore, Applicants respectfully submit that new claims 29-35 are in condition for allowance.

CHANGE IN ATTORNEY DOCKET NUMBER

A Request for Change in Attorney Docket Number is submitted herewith to change the docket number from 20002.0025A to 20002.0263.

CONCLUSION

All claims are believed to be in condition for allowance. If the Examiner believes that the present amendments still do not resolve all of the issues regarding patentability of the pending claims, Applicants invite the Examiner to contact the undersigned attorneys to discuss any remaining issues.

A Fee Sheet Transmittal is submitted to pay for the Terminal Disclaimer. No other fees are believed to be due at this time. Should any fee be required, however, please charge such fee to Swidler Berlin Shreff Friedman, LLP Deposit Account No. 195127, Order No. 20002.0263.

Respectfully submitted,
SWIDLER BERLIN SHREFF FRIEDMAN, LLP

By:


John P. Mulgrew, Registration No. 47,809
SWIDLER BERLIN SHREFF FRIEDMAN, LLP
3000 K Street, NW, Suite 300
Washington, D.C. 20007
(202) 424-7756 Telephone
(202) 295-8429 Facsimile

Dated: May 25, 2004

EXHIBIT H

CONFIDENTIAL EXHIBIT